

APPENDIX A

STOCK ASSESSMENT AND FISHERY EVALUATION REPORT

FOR THE GROUND FISH RESOURCES

OF THE BERING SEA/ALEUTIAN ISLANDS REGIONS

Compiled by

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of the Bering Sea and Aleutian Islands

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Stock Assessment and Fishery Evaluation Report for the Groundfish Resources of the Bering Sea/Aleutian Islands Region

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SUMMARY

by
The Plan Team for the Groundfish Fisheries
of the Bering Sea and Aleutian Islands

INTRODUCTION

The Guidelines for Fishery Management Plans published by the National Marine Fisheries Service (NMFS) require that a stock assessment and fishery evaluation (SAFE) report be prepared and reviewed annually for each fishery management plan (FMP). The SAFE reports are intended to summarize the best available scientific information concerning the past, present, and possible future condition of the stocks, marine ecosystems, and fisheries being managed under Federal regulation, thereby providing information to the Councils for determining annual harvest levels from each stock, documenting significant trends or changes in the resource, marine ecosystems, and fishery over time, and assessing the relative success of existing state and Federal fishery management programs. In the case of the FMP for the Groundfish Fishery of the Bering Sea and Aleutian Islands Area, the SAFE report is published in three sections: a “Stock Assessment” section, which comprises the bulk of the present document, and “Fishery Evaluation” and “Ecosystem Considerations” sections, which are bound separately.

The Stock Assessment section of the SAFE report for the Bering Sea and Aleutian Islands (BSAI) groundfish fisheries is compiled by the Plan Team for the Groundfish Fisheries of the BSAI from chapters contributed by scientists at NMFS Alaska Fisheries Science Center (AFSC) and includes a recommended acceptable biological catch (ABC) and an overfishing level (OFL) for each stock and stock complex managed under the FMP. The ABC recommendations are reviewed by the Scientific and Statistical Committee (SSC), which may confirm the Plan Team recommendations or develop its own. The ABC recommendations, together with social and economic factors, are considered by the North Pacific Fishery Management Council (Council) in determining total allowable catches (TACs) and other measures used to manage the fisheries.

The BSAI groundfish FMP requires that a draft of the SAFE report be produced each year in time for the October and December meetings of the Council. Because data from the current year’s AFSC trawl survey of the eastern Bering Sea shelf are usually not available prior to the September Plan Team meeting, however, most stock assessments are not revised in the first draft. For the present (final) draft, however, each stock or stock complex is represented in the report by a revised chapter containing the latest stock assessment.

Members of the Plan Team who compiled this SAFE report were Loh-lee Low (chair), Jane DiCosimo (plan coordinator), Michael Sigler, Andrew Smoker, Grant Thompson, Ivan Vining, Farron Wallace, Kristin Mabry, Brenda Norcross, and Lowell Fritz.

BACKGROUND INFORMATION

Management Areas and Species

The BSAI management area lies within the 200-mile U.S. Exclusive Economic Zone (EEZ) of the United States (Figure 1). International North Pacific Fisheries Commission (INPFC) statistical areas 1 and 2 make up the EBS. The Aleutian Islands (AI) region is INPFC area 5.

Four categories of finfishes and invertebrates have been designated for management purposes (Table 1). They are (a) prohibited species, (b) target species, (c) other species, (d) forage fish, and (e) non-specified species. This SAFE report describes the status of the stocks in categories (b) and (c) only.

Historical Catch Statistics

Catch statistics since 1954 are shown for the EBS subarea in Table 2. The initial target species was yellowfin sole. During the early period of these fisheries, total catches of groundfish reached a peak of 674,000 metric tons (t) in 1961. Following a decline in abundance of yellowfin sole, other species (principally walleye pollock) were targeted, and total catches rose to 2.2 million t in 1972. Walleye pollock is now the principal fishery, with recent catches approximately 1.4 million t in 2001 and 2002. Catches have since varied from one to two million t as catch restrictions and other management measures were placed on the fishery.

Catches in the Aleutian region have always been much smaller than those in the EBS. Target species have also been different (Table 3). Pacific ocean perch (POP) was the initial target species. As POP abundance declined, the fishery diversified to other species. During the early years of exploitation, overall catches of Aleutian groundfish reached a peak of 112,000 t in 1965. Atka mackerel is the largest fishery (44,000 t) in the AI, followed by Pacific cod (31,000 t). Total catches from the Aleutians in recent years have been about 100,000 t annually, after peaking at 191,000 t in 1996. Total BSAI catches through November 2, 2002 were 1.9 million t.

Recent Total Allowable Catches

Amendment 1 to the BSAI Groundfish FMP provides the framework to manage the groundfish resources as a complex. Maximum sustainable yield (MSY) for this complex was originally estimated at 1.8 to 2.4 million t. The optimum yield (OY) range was set at 85% of the MSY range, or 1.4 to 2.0 million t. The sum of the TACs equals OY for the BSAI groundfish complex, which is currently constrained by the 2.0 million t cap.

Fifteen percent (15%) of the total TACs is set aside as a reserve (except for pollock, squid, and hook-and-line and pot gear allocation of sablefish), which may be released during the season by the NMFS Regional Administrator. The ITAC, or initial TAC, for each species or complex is the remainder of the TAC after the subtraction of the reserve. Except as noted above, one half of the reserve, or 7.5 percent, is designated as a Community Development Quota (CDQ) reserve for use by CDQ participants. The reserve is released to directed fishing later in the fishing year. Ten percent of the pollock TAC is allocated as a directed fishing allowance for CDQ participants.

Definition of Acceptable Biological Catch and the Overfishing Level

Amendment 56 defined ABC and OFL for the BSAI groundfish fisheries. The new definitions are shown below, where the fishing mortality rate is denoted F , stock biomass (or spawning stock biomass, as appropriate) is denoted B , and the F and B levels corresponding to MSY are denoted F_{MSY} and B_{MSY} respectively.

Acceptable Biological Catch is a preliminary description of the acceptable harvest (or range of harvests) for a given stock or stock complex. Its derivation focuses on the status and dynamics of the stock,

environmental conditions, other ecological factors, and prevailing technological characteristics of the fishery. The fishing mortality rate used to calculate ABC is described next.

Overfishing is defined as any amount of fishing in excess of the maximum fishing mortality threshold (MFMT). This MFMT is prescribed through a set of six tiers which are listed below in descending order of preference, corresponding to descending order of information availability. The SSC will have final authority for determining whether a given item of information is “reliable” for the purpose of this definition, and may use either objective or subjective criteria in making such determinations. For Tier 1, a “pdf” refers to a probability density function. For Tiers 1-2, if a reliable pdf of B_{MSY} is available, the preferred point estimate of B_{MSY} is the geometric mean of its pdf. For Tiers 1-5, if a reliable pdf of B is available, the preferred point estimate is the geometric mean of its pdf. For Tiers 1-3, the coefficient α is set at a default value of 0.05, with the understanding that the SSC may establish a different value for a specific stock or stock complex as merited by the best available scientific information. For Tiers 2-4, a designation of the form “ $F_{X\%}$ ” refers to the F associated with an equilibrium level of spawning per recruit (SPR) equal to $X\%$ of the equilibrium level of spawning per recruit in the absence of any fishing. If reliable information sufficient to characterize the entire maturity schedule of a species is not available, the SSC may choose to view SPR calculations based on a knife-edge maturity assumption as reliable. For Tier 3, the term $B_{40\%}$ refers to the long-term average biomass that would be expected under average recruitment and $F=F_{40\%}$.

1) Information available: Reliable point estimates of B and B_{MSY} and reliable pdf of F_{MSY} .

1a) Stock status: $B/B_{MSY} > 1$
 $F_{OFL} = \mu_A$, the arithmetic mean of the pdf
 $F_{ABC} \leq \mu_H$, the harmonic mean of the pdf

1b) Stock status: $\alpha < B/B_{MSY} \leq 1$
 $F_{OFL} = \mu_A \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
 $F_{ABC} \leq \mu_H \times (B/B_{MSY} - \alpha)/(1 - \alpha)$

1c) Stock status: $B/B_{MSY} \leq \alpha$
 $F_{OFL} = 0$
 $F_{ABC} = 0$

2) Information available: Reliable point estimates of B , B_{MSY} , F_{MSY} , $F_{35\%}$, and $F_{40\%}$.

2a) Stock status: $B/B_{MSY} > 1$
 $F_{OFL} = F_{MSY}$
 $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%})$

2b) Stock status: $\alpha < B/B_{MSY} \leq 1$
 $F_{OFL} = F_{MSY} \times (B/B_{MSY} - \alpha)/(1 - \alpha)$
 $F_{ABC} \leq F_{MSY} \times (F_{40\%}/F_{35\%}) \times (B/B_{MSY} - \alpha)/(1 - \alpha)$

2c) Stock status: $B/B_{MSY} \leq \alpha$
 $F_{OFL} = 0$
 $F_{ABC} = 0$

3) Information available: Reliable point estimates of B , $B_{40\%}$, $F_{35\%}$, and $F_{40\%}$.

3a) Stock status: $B/B_{40\%} > 1$
 $F_{OFL} = F_{35\%}$
 $F_{ABC} \leq F_{40\%}$

3b) Stock status: $\alpha < B/B_{40\%} \leq 1$
 $F_{OFL} = F_{35\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$
 $F_{ABC} \leq F_{40\%} \times (B/B_{40\%} - \alpha)/(1 - \alpha)$

3c) Stock status: $B/B_{40\%} \leq \alpha$
 $F_{OFL} = 0$
 $F_{ABC} = 0$

4) Information available: Reliable point estimates of B , $F_{35\%}$, and $F_{40\%}$.

$F_{OFL} = F_{35\%}$
 $F_{ABC} \leq F_{40\%}$

5) Information available: Reliable point estimates of B and natural mortality rate M.

$$F_{OFL} = M$$

$$F_{ABC} \leq 0.75 \times M$$

6) Information available: Reliable catch history from 1978 through 1995.

OFL = the average catch from 1978 through 1995, unless an alternative value is established by the SSC on the basis of the best available scientific information

$$ABC \leq 0.75 \times OFL$$

OVERVIEW OF “STOCK ASSESSMENT” SECTION

Summary and Use of Terms

Plan Team recommendations for 2003 ABCs are summarized in Tables 4-5. The sum of the recommended ABCs for 2003 is about 3,330,000 t, nearly 147,000 t above the sum of 2002 ABCs. This is about 1.3 million t above the 2 million t TAC cap employed by the Council as a conservation measure. Overall, the status of the stocks continues to appear relatively favorable, although some stocks are declining due to poor recruitment in recent years. Total biomass for 2003 (19.8 million t) is relatively unchanged since last year. Stock status is summarized, ABC recommendations are given, and OFLs presented on a species-by-species basis in the remainder of this Overview, with the following conventions observed:

- 1) “Fishing mortality rate” refers to the full-selection F (i.e., the rate that applies to fish of fully selected sizes or ages), except in the case of the EBS walleye pollock assessment. In the EBS walleye pollock assessment model, an “average” fishing mortality rate is calculated by constraining the age-specific selectivities so that the average selectivity is 1.0 (in other age- or length-structured models, the selectivities are constrained so that the maximum is 1.0). It is important to remember that a full-selection F should be interpreted in the context of the selectivity schedule to which it applies.
- 2) “Projected age+ biomass” refers to the total biomass of all cohorts of ages greater than or equal to some minimum age, as projected for January 1 of the coming year. The minimum age varies from species to species. When possible, the minimum age corresponds to the age of recruitment listed in the respective stock assessment. Otherwise, the minimum age corresponds to the minimum age included in the assessment model. When a biomass estimate from the trawl survey is used as a proxy for projected age+ biomass, the minimum age is equated with the age of recruitment, even though the survey may not select that age fully and undoubtedly selects fish of younger ages to some extent. Note that a projected age+ biomass listed in this summary section may differ from a projected “exploitable” biomass listed in the corresponding stock assessment, which may be computed by multiplying biomass at age by selectivity at age and summing over all ages (in models assuming knife-edge recruitment, age+ biomass and exploitable biomass are equivalent).
- 3) “Exploitation rate” refers to the ratio between catch (in numbers) and start-of-year stock size (also in numbers). Where information is lacking, the exploitation rate is sometimes multiplied by start-of-year biomass to compute ABC.
- 4) Projected ABC, OFL, and biomass levels are reported to three significant digits, except when quoting a Council-approved value with more than three significant digits. Fishing mortality rates are reported to two significant digits.
- 5) The figures listed as last years ABCs correspond to the values approved by the Council. The figures listed as next years ABCs correspond to the Plan Team’s recommendations.

Projection Scenarios and Status Determination

A standard set of projections is required for each stock managed under tiers 1, 2, or 3 of Amendment 56. This set of projections encompasses seven harvest scenarios designed to satisfy the requirements of Amendment

56, the National Environmental Protection Act, and the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA).

For each scenario, the projections begin with the vector of 2002 numbers at age estimated in the assessment. This vector is then projected forward to the beginning of 2003 using the schedules of natural mortality and selectivity described in the assessment and the best available estimate of total (year-end) catch for 2002. In each subsequent year, the fishing mortality rate is prescribed on the basis of the spawning biomass in that year and the respective harvest scenario. In each year, recruitment is drawn from a distribution whose parameters consist of maximum likelihood estimates determined from the time series of recruitments estimated in the assessment. Because an environmental regime shift appears to have occurred around 1977, only year classes spawned after 1976 are included in this time series. Spawning biomass is computed in each year based on the time of peak spawning and the maturity and weight schedules described in the assessment. Total catch is assumed to equal the catch associated with the respective harvest scenario in all years. This projection scheme is run 1000 times to obtain distributions of possible future stock sizes, fishing mortality rates, and catches.

Five of the seven standard scenarios will be used in an Environmental Assessment prepared in conjunction with the final SAFE. These five scenarios, which are designed to provide a range of harvest alternatives that are likely to bracket the final TAC for 2003, are as follow (“max F_{ABC} ” refers to the maximum permissible value of F_{ABC} under Amendment 56):

Scenario 1: In all future years, F is set equal to max F_{ABC} . (Rationale: Historically, TAC has been constrained by ABC, so this scenario provides a likely upper limit on future TACs.)

Scenario 2: In all future years, F is set equal to a constant fraction of max F_{ABC} , where this fraction is equal to the ratio of the F_{ABC} value for 2003 recommended in the assessment to the max F_{ABC} for 2003. (Rationale: When F_{ABC} is set at a value below max F_{ABC} , it is often set at the value recommended in the stock assessment.)

Scenario 3: In all future years, F is set equal to 50% of max F_{ABC} . (Rationale: This scenario provides a likely lower bound on F_{ABC} that still allows future harvest rates to be adjusted downward when stocks fall below reference levels.)

Scenario 4: In all future years, F is set equal to the average F from the period 1997-2001. (Rationale: For some stocks, TAC can be well below ABC, and recent average F may provide a better indicator of F_{TAC} than F_{ABC} .)

Scenario 5: In all future years, F is set equal to zero. (Rationale: In extreme cases, TAC may be set at a level close to zero.)

Two other scenarios are needed to satisfy the MSFCMA’s requirement to determine whether a stock is currently in an overfished condition or is approaching an overfished condition. These two scenarios are as follow (for Tier 3 stocks, the MSY level is defined as $B_{35\%}$):

Scenario 6: In all future years, F is set equal to F_{OFL} .

Scenario 7: In 2003 and 2004, F is set equal to max F_{ABC} , and in all subsequent years, F is set equal to F_{OFL} .

Harvest scenarios #6 and #7 are intended to permit determination of the status of a stock with respect to its minimum stock size threshold (MSST). Any stock that is below its MSST is defined to be overfished. Any stock that is expected to fall below its MSST in the next two years is defined to be approaching an overfished condition. Harvest scenarios #6 and #7 are used in these determinations as follows:

Is the stock overfished? This depends on the stock's estimated spawning biomass in 2002:

- (1) If spawning biomass for 2003 is estimated to be below $\frac{1}{2} B_{35\%}$, the stock is below its MSST. If spawning biomass for 2003 is estimated to be above $B_{35\%}$, the stock is above its MSST.
- (2) If spawning biomass for 2003 is estimated to be above $\frac{1}{2} B_{35\%}$ but below $B_{35\%}$, the stock's status relative to MSST is determined by referring to harvest scenario #6. If the mean spawning biomass for 2013 is below $B_{35\%}$, the stock is below its MSST. Otherwise, the stock is above its MSST.

Is the stock approaching an overfished condition? This is determined by referring to harvest scenario #7:

- (1) If the mean spawning biomass for 2005 is below $\frac{1}{2} B_{35\%}$, the stock is approaching an overfished condition.
- (2) If the mean spawning biomass for 2005 is above $B_{35\%}$, the stock is not approaching an overfished condition.
- (3) If the mean spawning biomass for 2005 is above $\frac{1}{2} B_{35\%}$ but below $B_{35\%}$, the determination depends on the mean spawning biomass for 2015. If the mean spawning biomass for 2015 is below $B_{35\%}$, the stock is approaching an overfished condition. Otherwise, the stock is not approaching an overfished condition.

It is currently impossible to evaluate the status of stocks in Tiers 4 through 6 with respect to their MSSTs because stocks qualify for management under these tiers only if reference stock levels (such as MSST) cannot be estimated reliably.

Uncertainty / Ecosystem Considerations / Research

Uncertainty is addressed in individual assessments, and to some degree is addressed by the tiers used to establish ABCs. In some assessments (e.g., Pacific cod, sablefish), additional analysis of parameter uncertainty was undertaken, and the resulting ABC recommendations adjusted accordingly as part of the assessment. In other assessments (Greenland turbot, other species) uncertainty was dealt with by recommending a more precautionary ABC (below the maximum allowed under the tiers).

Ecosystem concerns were included in some individual stock assessments (e.g., walleye pollock, Pacific cod, sablefish). The Team was unable to isolate individual cases where ABC adjustments needed to be made to address ecosystem concerns. These discussions have been expanded since last year and the Team encouraged the authors to continue the development of an ecosystem analysis for next year. All of our groundfish species are predators or prey at some life stage. A review of ecosystem status and trends is provided in the Ecosystem Considerations chapter.

Walleye Pollock

Status and catch specifications (t) of **pollock** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data are current through 11/02/02.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
EBS	2001	10,500,000	2,350,000	1,842,000	1,400,000	1,388,276
	2002	9,800,000	3,530,000	2,110,000	1,485,000	1,484,927
	2003	11,100,000	3,530,000	2,330,000	n/a	n/a
AI	2001	106,000	31,700	23,800	2,000	824
	2002	106,000	31,700	23,800	1,000	1,079
	2003	175,000	52,600	39,400	n/a	n/a
Bogoslof	2001	300,000	60,200	8,470	1,000	29
	2002	232,000	46,400	4,310	100	38
	2003	227,000	45,300	34,000	n/a	n/a

Eastern Bering Sea:

The present assessment is a straightforward update of last year's assessment, incorporating new data from the 2002 fishery and bottom trawl and echo-integration trawl (EIT) surveys. The 2002 bottom trawl survey estimated a biomass of 4,820,000 t, an increase of 16% relative to the 2001 estimate. The 2002 EIT survey estimated a biomass of 3,600,000 t, an increase of 18% relative to the 2000 estimate (the last year an EIT survey was conducted). Other new inputs include age composition data from the 2001 fishery and the 2002 bottom trawl survey.

Seven alternative models are presented in the chapter, all of which follow the statistical age-structured approach that has been used for the last several years. All of these models give point estimates of 2003 age 3+ biomass in the range 10,200,000 t to 13,200,000 t. Concurring with the assessment authors, the Plan Team based its recommendations for 2003 on the reference model (Model 1), which is essentially identical to last year's model.

The current assessment indicates that biomass is higher than estimated in last year's assessment. For example, this year's estimate of 2001 age 3+ biomass (11,800,000 t) is 6% higher than last year's estimate of 2001 age 3+ biomass (11,100,000 t). Such variability is well within the confidence intervals of the estimates. The coefficient of variation (CV) for the 2001 biomass estimate produced last year was 39% and the CV for the same estimate produced this year was 42%. Figure 1.22 compares estimates of year class strength between the current and previous assessments. Relative to last year's assessment, the current assessment gives higher estimates for the 1999 and 2000 year classes, but a lower estimate for the 1996 year class.

The SSC has determined that reliable estimates of B_{MSY} and the probability density function for F_{MSY} exist for this stock, and that EBS walleye pollock therefore qualify for management under Tier 1. The senior assessment author continues to feel that the Tier 1 reference points are reliably estimated given the structure of the model, a conclusion with which the Plan Team concurs. The updated estimates of B_{MSY} and the harmonic and arithmetic means for F_{MSY} from the present assessment are 2,290,000 t, 0.52, and 1.1, respectively, compared to 2,140,000 t, 0.52, and 1.2, respectively, from last year's assessment. Projected spawning biomass for 2003 is 3,330,000 t (the confidence interval based on minus/plus one standard

deviation extends from 2,700,000 t to 3,960,000 t), placing EBS walleye pollock in sub-tier “a” of Tier 1. The maximum permissible value of F_{ABC} under Tier 1a is 0.52, the harmonic mean of the probability density function for F_{MSY} . A fishing mortality rate of 0.52 translates into a 2003 catch of 2,330,000 t, which would be the maximum permissible ABC under Tier 1a (compared to 2,110,000 t in last year’s assessment). This ABC is almost identical to the 2003 catch of 2,320,000 t that would be projected under an $F_{40\%}$ harvest rate. Last year, the senior assessment author, Plan Team, and SSC all recommended setting 2002 ABC at the maximum permissible value. This year, the senior author again recommends setting ABC at the maximum permissible value, a recommendation with which the Plan Team concurs.

Given that TAC will necessarily be set below the recommended ABC, the assessment also provides alternative harvest scenarios, including the seven standard scenarios analyzed in all age-structured assessments and two constant catch scenarios (1,300,000 t and 1,400,000 t).

The OFL fishing mortality rate under Tier 1a is 1.1, the arithmetic mean of the probability density function for F_{MSY} . A fishing mortality rate of 1.1 translates into a 2003 OFL of 3,530,000 t. The EBS walleye pollock stock is neither overfished nor approaching an overfished condition.

Aleutians:

The 2002 bottom trawl survey of the Aleutians Islands region resulted in a biomass estimate of 175,000 t (the confidence interval based on minus/plus one standard deviation extends from 133,000 t to 217,000 t), an increase of 65% relative to the 2000 estimate. Last year, the SSC determined that Aleutian pollock qualified for management under Tier 5. The maximum permissible ABC under Tier 5 is 75% of the product of the natural mortality rate (0.30) and biomass, giving a value of 39,400 t, which is the Plan Team’s recommended ABC for 2003. This is an increase of 65% relative to last year’s recommendation, an increase which is totally attributable to the change in the survey biomass estimate. The overfishing level under Tier 5 is the product of the natural mortality rate and biomass, giving an OFL of 52,600 t for 2003. As a Tier 5 stock, it is not possible to determine whether Aleutian pollock is overfished or whether it is approaching an overfished condition.

Bogoslof:

The 2002 hydroacoustic survey of the Bogoslof region resulted in a biomass estimate of 227,000 t (the confidence interval based on minus/plus one standard deviation extends from 200,000 t to 254,000 t). Last year, the SSC determined that Bogoslof pollock qualified for management under Tier 5. The maximum permissible ABC under Tier 5 is 75% of the product of the natural mortality rate (0.20) and biomass, giving a value of 34,000 t, which is the Plan Team’s recommendation for 2003 ABC. This recommendation is 2% lower than last year’s Plan Team recommendation, but much higher than last year’s SSC recommendation of 4,310 t. If the formula used last year by the SSC is applied again, the resulting fishing mortality rate is 0.019, giving a 2003 ABC of 4,070 t. The overfishing level under Tier 5 is the product of the natural mortality rate and biomass, giving an OFL of 45,300 t for 2003. As a Tier 5 stock, it is not possible to determine whether Bogoslof pollock is overfished or whether it is approaching an overfished condition.

Recommendations for next year’s assessment:

The Plan Team suggests that the assessment authors consider presenting additional graphs similar to the current Figure 1.33, with future catches projected on the basis of one or more of the standard harvest scenarios, rather than constant catch scenarios only. Also, the Plan Team suggests that the assessment authors consider presenting confidence intervals around the recommended ABC.

Pacific Cod

Status and catch specifications (t) of **Pacific cod** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data are current through 11/2/02.

<u>Area</u>	<u>Year</u>	<u>Age 3+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2001	1,320,000	248,000	188,000	188,000	176,659
	2002	1,540,000	294,000	223,000	200,000	184,937
	2003	1,680,000	324,000	223,000	n/a	n/a

For the most part, the present assessment is a straightforward update of last year's assessment, incorporating new catch and survey information. However, one small change in the model was made at the request of the SSC, namely, the inclusion of a separate set of fishery selectivity parameters for the period 2000-2002. This year's EBS bottom trawl survey resulted in a biomass estimate of 617,000 t, down 26% from the 2001 estimate and near the minimum for the time series (534,000 t). The Aleutian Islands were surveyed in 2002. Biomass decreased 39% from 2000 and is the lowest value of the time series. Estimates of abundance are higher for the 2003 assessment compared to the 2002 assessment. For example, estimated 2003 spawning biomass for the BSAI stock is 423,000 t, up about 4% from last year's F_{ABC} projection for 2003. The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, and that this stock therefore qualifies for management under tier 3. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 431,000 t, 0.35 and 0.42, respectively. The point estimates for $F_{40\%}$ and $F_{35\%}$ are substantially higher than last year's values of 0.30 and 0.36, respectively. Pacific cod qualify for management under sub-tier "b" of tier 3 because projected biomass for 2003 is about 1% less than $B_{40\%}$. Fishing at an instantaneous rate of 0.35 is projected to result in a 2003 catch of 278,000 t, which is the maximum permissible ABC under Amendment 56. The ABC for 2003 recommended by the authors is 245,000 t, 12% below the maximum permissible and based on a risk-averse optimization procedure which considers uncertainty in the estimates of the survey catchability coefficient and the natural mortality rate in the computation of an $F_{40\%}$ harvest level.

The Plan Team recommends setting 2003 ABC at 223,000 t, equal to the 2002 ABC and 20% below the maximum permissible level. This ABC corresponds to a fishing mortality rate of 0.28, below the value of 0.35 which constitutes the upper limit on F_{ABC} under tier 3b. The Team is concerned about the decline in spawning biomass. Estimated spawning biomass has declined almost continuously since 1988. Another biological concern is that three of the last five year classes (assessed at age 3) are "below average" and an "above average" year class hasn't occurred since 1992. The Team also is concerned that Pacific cod abundance may be overestimated due to the assumed values of survey catchability and natural mortality and their interaction with the estimated parameters for growth and dome-shaped selectivity. Trawl catchability is assumed to equal 1, yet estimated age-3+ biomass is much greater than survey biomass (Fig. 2.9). The model estimate of trawl survey selectivity is sharply dome-shaped (Table 2.24), implying that significant amounts of large cod are missed by the shelf trawl survey. However, the Plan Team is concerned that comparison of 2002 slope and shelf survey length data may not support this implication, meaning that the dome-shaped selectivity currently estimated for the shelf survey may not be due to large fish residing on the slope at the time of the survey.

The Plan Team's recommended OFL was determined from the tier 3b formula, where fishing at a rate of 0.41 gives a 2003 catch of 324,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Recommendations for next year's assessment:

A fundamental challenge for the Pacific cod assessment is the lack of age data, which exacerbates the uncertainty in natural mortality, growth, and dome-shaped selectivity. Research has been completed on an appropriate method for ageing Pacific cod. The Team strongly recommends that production ageing of Pacific cod be given a high priority.

The Team also recommends that the authors add their comparison of slope and shelf survey length data to the stock assessment model. The additional data provides information about the degree of dome-shape for the shelf survey compared to the slope survey and may improve the accuracy of the selectivity estimates.

Yellowfin Sole

Status and catch specifications (t) of **yellowfin sole** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data are current through 11/02/02.

<u>Area</u>	<u>Year</u>	<u>Age 2+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2001	2,380,000	209,000	176,000	113,000	63,578
	2002	1,597,000	136,000	115,000	86,000	74,861
	2003	1,550,000	136,000	114,000	n/a	n/a

The present assessment is a straightforward update of last year's assessment, including incorporation of new catch and survey information. This year's EBS bottom trawl survey resulted in a biomass estimate of 2,000,000 t, an increase of 8% from last year's survey. As in last year's assessment, the authors let catchability differ from 1.0 with a temperature effect.

Reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby qualifying yellowfin sole for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 385,000 t, 0.12, and 0.14, respectively. Given that the projected 2003 spawning biomass of 445,000 t exceeds $B_{40\%}$, the Plan Team's ABC and OFL recommendations for 2003 were calculated under sub-tier "a" of Tier 3. The Plan Team recommends setting F_{ABC} at the $F_{40\%}$ (=0.12) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2003 ABC of 115,000t.

The Plan Team's OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.14 gives a 2003 OFL of 135,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

The yellowfin sole stock continues to decline, as do several other flatfish stocks, despite low exploitation rates. The decline is due to the low recruitment in the last decade.

In response to SSC recommendations, the authors evaluated the static size-at-age assumption and considered reconfiguring the assessment in a manner that would permit management of yellowfin sole under Tier 1. The authors compared size-at-age data from 1987, 1994, 1999-2001, and found that static size at age is a reasonable assumption. To begin development of an assessment that would permit management of this stock under Tier 1, the authors fit a Ricker spawner-recruit curve to model estimates of female spawning biomass and age 2 recruits (Figure 3.10). However, the assessment authors and other coworkers also found that recruitment of yellowfin sole was related to advection in the EBS. From this, it was concluded that using the MSY estimate from the spawner-recruit curve and managing this stock under Tier 1 would not be advisable at this time.

Greenland turbot

Status and catch specifications (t) of **Greenland turbot** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data are current through 11/02/02.

<u>Area</u>	<u>Year</u>	<u>Age 1+ Biomass</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2001	210,000	31,000	8,400	8,400	5,312
	2002	208,000	36,500	8,100	8,000	2,753
	2003	112,000	17,800	5,880	n/a	n/a

This year's assessment incorporates new catch and length frequency data from the fishery, and new abundance and size composition data from the longline survey and the shelf and slope bottom trawl surveys. The new EBS slope survey information was helpful in resolving some of the previous assessment uncertainty. The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby Greenland turbot for management under Tier 3 of the BSAI Groundfish FMP. Updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 54,400 t, 0.26, and 0.32, respectively. Projected spawning biomass for 2003 is 64,900 t, placing Greenland turbot in sub-tier "a" of Tier 3. The maximum permissible value of F_{ABC} under Tier 3a translates into a 2003 catch of 14,700 t.

The Plan Team agrees with the authors' recommendation to set the 2003 ABC at a value less than the maximum permissible. Using F_{ABC} = 5-year average results in a 2003 ABC of 5,880 t corresponding to a full selection fishing mortality rate of 0.10. The OFL fishing mortality rate is computed under Tier 3a, $F_{OFL} = F_{35\%} = 0.32$, and translates into a 2003 OFL of 17,800 t. The Team is concerned about further stock declines and the continued lack of apparent recruitment.

The Plan Team and author acknowledged large uncertainties in the assessment. Additional slope trawl surveys are needed to improve measurement of abundance trend and estimates of biomass.

Arrowtooth flounder

Status and catch specifications (t) of **arrowtooth flounder** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data are current through 11/02/02.

<u>Area</u>	<u>Year</u>	<u>Age 1+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2001	701,000	141,500	117,000	22,011	14,056
	2002	671,000	137,000	113,000	16,000	11,443
	2003	597,000	139,000	112,000	n/a	n/a

The present assessment introduces a new, split-sex model for arrowtooth flounder based on the ADMB programming environment. This year's EBS shelf bottom trawl survey resulted in a biomass estimate of 355,000 t, a 13% decrease relative to last year's estimate. The EBS slope survey estimated 61,000 t, for a total of 416,000 t in the EBS. The Aleutian bottom trawl survey estimated 88,700 t, a 5% decrease from the 2000 survey.

For several years, there have been discussions regarding the high ratio of female to male arrowtooth flounder. A model was developed this year, enabling estimation of a separate natural mortality rate for males. The natural mortality for males was estimated to be 0.281 (0.2 had been used in the past). The new, split-sex model led to a change in estimated selectivity for both males and females, which, together with the change in M for males, accounts for the relatively large changes in the $F_{40\%}$ and $F_{35\%}$ estimates from previous years.

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby qualifying arrowtooth flounder for management under Tier 3. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 206,000 t, 0.30, and 0.38, respectively. Given that the projected 2003 spawning biomass of 436,000 t exceeds $B_{40\%}$, the Plan Team's ABC and OFL recommendations for 2003 were calculated under sub-tier "a" of Tier 3. The Plan Team recommends setting F_{ABC} at the $F_{40\%}$ (=0.30) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2003 ABC of 112,000t.

The OFL fishing mortality rate under Tier 3a is $F_{35\%}$ (=0.38), translating into a 2003 OFL of 139,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Rock sole

Status and catch specifications (t) of **rock sole** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data are current through 11/02/02.

Area	Year	Age 2+ Bio.	OFL	ABC	TAC	Catch
BSAI	2001	1,940,000	271,000	228,000	75,000	29,475
	2002	1,850,000	268,000	225,000	54,000	41,621
	2003	877,000	132,000	110,000	n/a	n/a

The present assessment features significant changes in the model and new input data, including addition of the 2001 fishery age composition, 2001 survey age composition, and 2002 EBS bottom trawl survey biomass point estimate and stand error. This year's EBS bottom trawl survey resulted in a biomass estimate of 1,900,000 t, a 21% decrease from last year's survey estimate.

Previous assessments of this stock assumed a catchability of 1.0, whereas the new model estimates catchability at a value of 1.8. The authors corroborated this finding with experimental data indicating that the bridles used on the standard research trawl tend to herd rock sole into the net, thus increasing catchability. In addition to estimating catchability as a constant, this year's assessment also investigated the possibility of a linear relationship between catchability and temperature. However, the estimated value of the slope coefficient was close to zero, so the authors decided to retain the assumption of constant catchability.

The new model provides a statistically significant improvement over the previous model. However, one of the results of adopting the new model is that the estimates of abundance are approximately half of the previously estimated values. Thus, while there was a 53% decrease between the 2002 age 2+ biomass projected last year and the 2003 age 2+ biomass projected this year, this is due largely to changes in the assessment model. For example, this year's estimate of age 2+ biomass is 970,000 t, meaning that the decrease from 2002 to 2003 estimated by this year's model is only 10%.

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby qualifying this stock for management under Tier 3. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 158,000 t, 0.18 and 0.21, respectively. Given that the projected 2003 spawning biomass of 303,000 t exceeds $B_{40\%}$, the Plan Team's ABC and OFL recommendations for 2003 were calculated under sub-tier "a" of Tier 3. The Plan Team recommends setting F_{ABC} at the $F_{40\%}$ (=0.18) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2003 ABC of 110,200t.

The Plan Team's OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.21 gives a 2003 OFL of 132,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

In response to an SSC recommendation, the authors considered reconfiguring the assessment in a manner that would permit management of rock sole under Tier 1. To begin development of an assessment that would permit management of this stock under Tier 1, the authors fit a Ricker spawner-recruit curve to model estimates of female spawning biomass and age 4 recruits (Figure 6.8). However, the assessment authors and other coworkers also found that recruitment of rock sole was related to advection in the EBS. From this, it was concluded that using the MSY estimate from the spawner-recruit curve and managing this stock under Tier 1 would not be advisable at this time.

Recommendations for next year's assessment:

The Plan Team recommends that the authors attempt to incorporate results from the recent experiments regarding survey “herding” of rock sole into the assessment model itself, perhaps in the form of a prior distribution on survey catchability. However, the Plan Team understands that this may be difficult, given that the coefficient estimated in the herding experiment is not the same as the catchability coefficient used in the assessment.

Flathead Sole

Status and catch specifications (t) of **flathead sole** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data are current through 11/02/02.

<u>Area</u>	<u>Year</u>	<u>Age 3+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2001	618,000	102,000	84,000	40,000	17,087
	2002	695,000	101,000	83,000	25,000	15,419
	2003	550,000	81,000	66,000	n/a	n/a

For the most part, the present assessment is a straightforward update of last year's, incorporating new catch, discard, survey biomass, and length composition data. One small change in the model is that sex-specific age compositions from the survey are now used. Also, the sex-specific age-length conversion matrices and weight at age were re-estimated this year. This year's EBS bottom trawl survey resulted in a biomass estimate of 575,000 t, a 12% increase relative to last year's estimate, although total biomass and spawning biomass continue to decline.

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby qualifying it for management under Tier 3. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 124,000 t, 0.29, and 0.36, respectively. Given that the projected 2003 spawning biomass of 225,000 t exceeds $B_{40\%}$, the Plan Team's ABC and OFL recommendations for 2003 were calculated under sub-tier “a” of Tier 3. Model projections indicate that this stock is neither overfished nor approaching an overfished condition, and that stock biomass is relatively high. The Plan Team recommends setting F_{ABC} at the $F_{40\%}$ (=0.29) level, which is the maximum permissible level under Tier 3a. Projected harvesting at the $F_{40\%}$ level gives a 2003 ABC of 66,000 t. The Plan Team's OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.37 gives a 2003 OFL of 81,000 t.

Alaska plaice

Status and catch specifications (t) of **Alaska plaice** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. Catch reports for 2001 and 2002 also include other flatfish. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data are current through 11/02/02.

Area	Year	Age 1 + Bio.	OFL	ABC	TAC	Catch
BSAI	2001	865,000	147,000	122,000	28,000	9,577
	2002	1,110,000	172,000	143,000	30,000	12,291

Alaska plaice was first managed as an individual species in 2002, having previously been managed as the principal species in the “other flatfish” complex. Apart from this reclassification, however, the present assessment is a straightforward update of last year’s assessment, incorporating 2001 and 2002 total catch and discard data and 2002 trawl survey data. This year’s EBS bottom trawl survey resulted in a biomass estimate of 425,000t, a 21% decrease relative to last year’s survey estimate, but only a 4% decrease relative to the 2000 survey estimate.

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby qualifying Alaska plaice for management under Tier 3. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 131,000 t, 0.28, and 0.34, respectively. The values are almost identical to those for 2002. Given that the projected 2003 spawning biomass of 255,000 t exceeds $B_{40\%}$, the Plan Team’s recommendations for OFL and ABC for 2003 were calculated under sub-tier “a” of Tier 3. Projected harvesting at the $F_{40\%}$ level results in a 2003 ABC of 137,000 t.

The OFL recommendation was determined from the Tier 3a formula. The $F_{35\%}$ value for Alaska plaice (0.34) results in a 2003 OFL of 165,000 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Other flatfish complex

Status and catch specifications (t) of **other flatfish** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team.

	Year	Age 1 + Bio.	OFL	ABC	TAC	Catch
BSAI	2003	107,000	21,400	16,000	n/a	n/a

Following the removal of Alaska plaice from this category, the species currently harvested in the “other flatfish” category include Dover sole, rex sole, longhead dab, Sakhalin sole, starry flounder, butter sole, and English sole. Of those, starry flounder and rex sole comprise 89% of the catch.

Because of insufficient information about these species, no model analyses are possible. The assessment incorporates 2001 and 2002 total catch and discard data and 2002 trawl survey information. This year’s EBS bottom trawl survey resulted in biomass estimates of 97,900 t, a 25% increase relative to last year’s estimate. Adding the AI bottom trawl survey estimate produces a BSAI biomass estimate of 107,000 t.

The SSC has determined that reliable estimates of $F_{40\%}$ and $F_{35\%}$ exist for this stock complex, thereby qualifying “other flatfish” for management under Tier 4. However, the assessment authors have suggested that this determination may have been premature. Because there appears to be much more variability among $F_{40\%}$ values between flatfish species than among natural mortality rates, the assessment authors have

recommended that the SSC reclassify “other flatfish” for management under Tier 5, using a value of 0.2 for the natural mortality rate. Anticipating that the SSC will concur, the Plan Team’s recommendations are based on Tier 5 formulae. It should be noted that the Tier 5 formulae are more conservative than the Tier 4 formulae in this instance.

The Plan Team recommends setting F_{ABC} at the 0.75M level (=0.15), which is the maximum permissible level under Tier 5. Projected harvesting at the 0.75M level gives a 2003 ABC of 16,000 t, a decrease from the 2002 ABC of 18,100 t. This decrease is due to the recommended change in management tier for the complex. (Note: The authors’ recommended ABC in the assessment is slightly different, due to the authors’ use of Baranov’s exploitation rate to compute catch.)

The Plan Team recommends a 2003 OFL of 21,400 t, based on the Tier 5 $F=M$ formula. (Note: The authors’ recommended OFL in the assessment is slightly different, due to the authors’ use of Baranov’s exploitation rate to compute catch.) It is not possible to determine whether the “other flatfish” complex is overfished or whether it is approaching an overfished condition because it is not managed under Tiers 1-3.

Sablefish

Status and catch specifications (t) of **sablefish** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data are current through 11/02/02.

<u>Area</u>	<u>Year</u>	<u>Age 4+ Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
EBS	2001	20,000	1,910	1,560	1,560	842
	2002	28,000	2,900	1,930	1,930	893
	2003	31,000	4,290	2,550	n/a	n/a
AI	2001	38,000	3,070	2,500	2,500	1,033
	2002	39,000	3,850	2,550	2,550	994
	2003	39,000	4,590	2,740	n/a	n/a

Sablefish abundance increased during the mid-1960s due to strong year classes from the late 1950s and 1960s. Abundance subsequently dropped during the 1970s due to heavy fishing; catches peaked at 56,988 t in 1972. The population recovered due to exceptional year classes from the late 1970s; spawning abundance peaked again in 1987. The population then decreased because these exceptional year classes are dying off.

The survey abundance index increased 5% in number and 7% in weight from 2001 to 2002. These increases follow increases from 2000 to 2001 and decreases from 1999 to 2000, so that relative abundance in 2002 is about 10% higher than in 1999. Fishery abundance data for 2002 were not analyzed because the fishery remains open. Exploitable and spawning biomass are projected to increase 6 and 3%, respectively, from 2002 to 2003. Alaska sablefish abundance now appears moderate and increased from recent lows. Projected 2003 spawning biomass is 39% of unfished spawning biomass, having been as low as 35% during 1998 to 2000. The increase confirms the projection from last year’s assessment that abundance would increase due to the above average 1997 year class. The 1997 year class is an important part of the total biomass and is projected to account for 24% of 2003 spawning biomass. Another year class likely is above average, the 1998 year class. Whether sablefish abundance falls after the 2003 peak depends on the actual strength of the 1998 year class.

A decision analysis was completed to determine what catch levels likely will avoid the historic low abundance observed in 1979. The decision analysis indicates that a yield of 18,400 t has only 0.2 probability of reducing 2007 spawning biomass below the historic low. The maximum permissible yield from an

adjusted $F_{40\%}$ strategy is much higher, 25,400 t, but with a higher probability (0.6) of decreasing 2007 spawning biomass below the historic low. The BSAI and GOA Plan Teams recommended a 2003 ABC of 18,400 t for the combined stock, a yield with low probability of reducing spawning biomass below the historic low and a yield six percent higher than the 2002 ABC of 17,300 t, consistent with recent increases sablefish abundance.

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{30\%}$ existed for this stock, and that this stock therefore qualifies for management under Tier 3 of the BSAI Groundfish FMP. The updated point estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ from the present assessment are 216,000 t (combined across the EBS, AI, and GOA), 0.133, and 0.164, respectively. Projected spawning biomass (combined areas) for 2003 is 210,000 t, placing sablefish in sub-tier “b” of Tier 3. The maximum permissible value of F_{ABC} under Tier 3b is computed as follows:

$$F_{ABC} \leq F_{40\%} \times (B_{2003}/B_{40\%} - 0.05)/(1 - 0.05) = 0.133 \times (210,000/216,000 - 0.05)/0.95 = 0.13$$

A fishing mortality rate of 0.13 translates into a 2003 catch (combined areas) of 25,400 t, which would be the maximum permissible ABC under Amendment 56. The Plan Team’s recommended 2003 ABC is 18,400 t and corresponds to $F = 0.081$. A 5-year exponential weighting of longline survey relative abundance may be used to apportion the combined 2003 ABC among regions, resulting in the following values: EBS–2,550 t, AI–2,740 t, and GOA–13,110 t.

The OFL fishing mortality rate is computed under Tier 3b as follows:

$$F_{OFL} = F_{35\%} \times (B_{2003}/B_{35\%} - 0.05)/(1 - 0.05) = 0.164 \times (210,000/216,000 - 0.05)/0.95 = 0.16$$

A fishing mortality rate of 0.16 translates into a 2003 OFL (combined areas) of 30,900 t. Using the survey-based apportionment scheme described above, 2003 OFL also may be apportioned among regions and results in the following values: EBS–4,290 t, AI–4,590 t, and GOA–22,020 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Pacific ocean perch (POP)

Status and catch specifications (t) of **Pacific ocean perch**. Biomass corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data are current through 11/02/02.

Area	Year	Age 3 + Bio.	OFL	ABC	TAC	Catch
BS & AI	2001	n/a	13,800	11,900	11,930	16,735
BSAI	2002	377,000	17,500	14,800	14,800	11,221
BSAI	2003	375,000	17,900	15,100	n/a	n/a

The present assessment is a straightforward update of last year’s assessment, including incorporation of 2001 catch, 2001 fishery age composition, and biomass and size composition from the 2002 AI bottom trawl survey. The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby qualifying Pacific ocean perch for management under Tier 3. The current estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ are 137,000t, 0.048, and 0.057, respectively. Projected spawning biomass for 2003 is 135,000 t, placing POP in sub-tier “b” of Tier 3. The maximum F_{ABC} value allowed under Tier 3b is computed as follows:

$$F_{ABC} \leq F_{40\%} \times (B_{2003}/B_{40\%} - 0.05)/(1 - 0.05) = 0.048 \times (135,000/137,000 - 0.05)/0.95 = 0.047$$

Projected harvesting at a fishing mortality rate of 0.047 gives a 2003 catch of 15,100 t, which is the authors' and Plan Team's recommended ABC. The team concurs with the authors' recommendation that ABCs be set regionally based on the 2002 apportionment as follows: BS = 2,410 t, Eastern Aleutians (Area 541) = 3,495 t, Central Aleutians (Area 542) = 3,330 t, Western Aleutians (Area 543) = 5,835 t.

The OFL fishing mortality rate is computed under Tier 3b as follows:

$$F_{OFL} = F_{35\%} \times (B_{2003} / B_{40\%} - 0.05) / (1 - 0.05) = 0.057 \times (135,000 / 137,000 - 0.05) / 0.95 = 0.056$$

Projected harvesting at a fishing mortality rate of 0.056 gives a 2003 catch of 17,900 t, which is the authors' and Plan Team's recommended OFL for the BSAI. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Other Red Rockfish

Status and catch specifications (t) of **Other red rockfish**. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch is reported through 11/02/02.

	Area	Year	Survey Biomass	OFL	ABC	TAC	Catch
Northern	BSAI	2002	150,000	9,020	6,760	BS	BS
						319	109
						AI	AI
						6741	3,951
		2003	156,000	9,330	7,000	n/a	n/a

Through 2000, the other red rockfish complex was split out into northern/sharpchin and rougheye/shortraker groups in the AI, and a combined other red rockfish group for the eastern Bering Sea. In 2002, sharpchin rockfish was moved into the other rockfish complex.

In 2001 and 2002, the Plan Team recommended that the complex be managed as single species. The Plan Team noted a conservation issue related to managing rockfish in a complex, namely, the risk that one stock would be fished disproportional to its abundance. This is especially likely when one species has a higher value to the fishery than the other species. This has happened in the other red rockfish complex, and the assessment shows that on a species-by-species basis, catches have sometimes exceeded current estimates of what OFL might have been had OFL likewise been set on a species-by-species basis (e.g., rougheye rockfish in the AI in 1997 and 2001 and northern rockfish in the BS in 2000).

In 2001, the Plan Team, SSC, AP, and Council recommended separating shortraker and rougheye rockfish species and setting BSAI area-wide ABCs and TACs for 2002. However, NMFS was unable to implement those recommendations because of the difficulty in identifying shortraker and rougheye rockfishes to species. NMFS established separate BS and AI TACs for northern rockfishes and separate BS and AI TACS for the combined shortraker/rougheye rockfishes category.

Staff with the NMFS Regional Office and Observer Program met in August 2002 to discuss data issues related to managing these groundfish at the species and area levels. The team concurred with NMFS staff recommendations to:

1. retain a single TAC for shortraker/rougheye for 2003;
2. implement changes in observer sampling procedures to improve species composition data on the proportion of shortraker and rougheye rockfish in longline sets;
3. monitor whether the changes in procedures result in significant improvements in the available data;
4. assess the feasibility of a system to utilize species composition data from observers to estimate the composition of the commercial catch.

The Plan Team continues to support single species management for this complex, but defers to the proposed analysis for revising management of target and non-target species management. The team endorses the Council procedure for setting a combined BSAI OFLs and ABCs for northern rockfish and shortraker/rougheye rockfishes in the interim.

The SSC has determined that a reliable estimate of the natural mortality rate exists for the stocks in this complex, thereby qualifying “other red rockfish” for management under Tier 5. The Plan Team recommends setting F_{ABC} at the maximum permissible level under Tier 5, which is 75% of M . Accepted values for M for these stocks are: rougheye rockfish--0.025, shortraker rockfish--0.030, and northern rockfish--0.060. Harvesting at these rates gives a 2003 BSAI ABC for northern rockfish of 7,000 t and a 2003 BSAI ABC for shortraker/rougheye rockfishes of 967 t.

The Plan Team’s recommended OFLs for 2003 are based on Tier 5 formula, where $F_{OFL}=M$. The recommended BSAI OFLs are 9,330 t for northern rockfish and 1,290 t for shortraker/rougheye rockfishes. It is not possible to determine whether the “other red rockfish” complex is overfished or whether it is approaching an overfished condition because it is managed under Tier 5.

Other rockfish complex

Status and catch specifications (t) of **other rockfish** (primarily thornyheads) in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data are current through 11/02/02.

Area	Year	Survey Bio.	OFL	ABC	TAC	Catch
EBS	2001	6,880	480	360	360	293
	2002	6,880	482	361	361	399
	2003	18,000	1,280	960	n/a	n/a
AI	2001	12,900	900	680	680	605
	2002	12,900	901	676	676	547
	2003	15,000	846	634	n/a	n/a

This year’s assessment includes a new survey biomass estimate, catch distribution maps, updated catch data, and length frequency graphs for light dusky rockfish and shortspine thornyheads. It also includes a recommendation from the assessment authors to assign a separate ABC for light dusky rockfish. This recommendation was based in part on an estimated value of 0.34 for the average exploitation rate of light dusky rockfish during the period 1997-2002. The Plan Team feels this value is likely an overestimate. While there is no reason to suspect that catches have been overestimated during this period, survey biomass estimates have not decreased, implying that biomass may be underestimated by the survey (i.e., if the exploitation rate were truly 0.34, it seems likely that a long-lived species such as light dusky rockfish would have undergone a significant decrease in abundance). Therefore, the Plan Team does not concur with the author’s recommendation to assign a separate ABC for light dusky rockfish at this time, instead deferring any recommendations on separating species from complexes to the proposed analysis for revising management of target and non-target groundfish species.

The SSC has determined that a reliable estimate of the natural mortality rate exists for this complex, thereby qualifying “other rockfish” for management under Tier 5. The Plan Team recommends setting F_{ABC} at the maximum value allowable under Tier 5, which is 75% of M (0.07), or 0.053. Multiplying this rate by the best estimate of complex-wide biomass gives a 2003 ABC of 960 t in the EBS and 634 t in the Aleutian Islands.

The Plan Team’s recommended OFLs are based on the Tier 5 formula, giving a 2003 OFL of 1,280 t in the EBS and 846 t in the AI. It is not possible to determine whether the “other rockfish” complex is overfished or whether it is approaching an overfished condition because it is managed under Tier 5.

Atka mackerel

Status and catch specifications (t) of **Atka mackerel** in recent years. Biomass for each year corresponds to the projection given in the SAFE report issued in the preceding year. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data for 2002 are current through 10/12/02.

Area	Year	Age 3+ Bio.	OFL	ABC	TAC	Catch
BSAI	2001	553,000	138,000	58,700	58,700	56,521
	2002	439,700	82,300	49,000	49,000	42,055
	2003	358,000	99,700	51,000	n/a	n/a

The present assessment introduces a new model for the Atka mackerel stock based on NMFS’ “Stock Assessment Toolbox,” which utilizes the ADMB modeling environment. In addition, new catch data, 2001 fishery age data, and the AI survey biomass estimate were incorporated.

The new model is a significant improvement over previous years’ models. The new approach and software allowed the selectivity relationship to be modeled with a smoothed non-parametric relationship with penalties controlling the degree of change and curvature. Selectivity was allowed to vary annually (with low constraints between years) with a penalty imposed on sharp shifts in selectivity between ages. The selectivity of the recent fishery in the current model is asymptotic, but has lower selectivities of 4-6 year-old fish than the curve used in last year’s assessment. The 1998 year class is showing strength and was included in the 2002 assessment because of its appearance in the 2001 fishery and 2000 survey age composition.

The SSC has determined that reliable estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ exist for this stock, thereby qualifying Atka mackerel for management under Tier 3. The current estimates of $B_{40\%}$, $F_{40\%}$, and $F_{35\%}$ are 178,000t, 0.66, and 0.84, respectively. Projected spawning biomass for 2003 is 212,000 t, placing Atka mackerel in sub-tier “a” of Tier 3. The assessment authors recommend setting F_{ABC} at the maximum permissible level, which would give a 2003 ABC of 82,800 t.

The Plan Team disagrees with the author’s recommendation and instead recommends a 2003 ABC of 51,000 t based on the average fishing mortality over the last five years (Scenario 4). The Plan Team used Scenario 4 as the basis for its ABC recommendation rather than the maximum permissible value ($F_{40\%}$) because of tentativeness regarding the structure of the new model, the level of uncertainty associated with the trawl survey biomass estimates, the fact that spawning biomass under an $F_{40\%}$ strategy is projected to drop below $B_{40\%}$ in 2004, and the fact that a 2003 ABC of 82,800 t would constitute a 69% increase from the 2002 ABC of 49,000t.

To apportion ABCs among areas, the authors used a weighted average of the 4 most recent survey estimates of the biomass distribution, where the greatest weight is assigned to the 2002 survey. When applied to the

recommended ABC of 51,000 t, this formula gives the following subarea-specific ABCs: Eastern Bering Sea and Eastern Aleutians = 8,600 t (16.8%), Central Aleutians = 23,800 t (46.6%), Western Aleutians = 18,600 t (36.5%).

The OFL was determined from the Tier 3a formula, where an $F_{35\%}$ value of 0.84 gives a 2003 OFL of 99,700 t. Model projections indicate that this stock is neither overfished nor approaching an overfished condition.

Recommendations for future assessments:

In the 1994, 1997, and 2002 Aleutian Islands surveys, significant concentrations of Atka mackerel biomass were detected in the Eastern Aleutian Islands district as a result of large catches from a single haul. The Plan Team recommends that sampling intensity in this area be increased to reduce uncertainty in the survey biomass estimate.

Squid and Other Species Complex

Status and catch specifications (t) of **squid and other species** (sharks, skates, sculpins, octopus.) in recent years. The OFL and ABC for 2003 are those recommended by the Plan Team. Catch data are current through 11/02/02.

Squid

<u>Area</u>	<u>Year</u>	<u>Biomass</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
BSAI	2001	n/a	2,620	1,970	1,970	1,763
	2002	n/a	2,620	1,970	1,970	784
	2003	n/a	2,620	1,970	n/a	n/a

Other Species

<u>Area/BSAI</u>	<u>Year</u>	<u>Survey Bio.</u>	<u>OFL</u>	<u>ABC</u>	<u>TAC</u>	<u>Catch</u>
	2001					
	2002	667,000	78,900	39,100	30,825	26,467
	2003	695,000	81,100	60,800	n/a	n/a

The SSC has determined that a reliable catch history from 1978 through 1995 exists for squid, thereby qualifying this stock complex for management under Tier 6. Under Tier 6, OFL is set equal to the average catch from 1978 through 1995 unless an alternative value is established by the SSC on the basis of the best available scientific information, and ABC is constrained to be no greater than 75% of OFL. The average squid catch from 1978 through 1995 was 2,620 t, which is the Plan Team's recommended OFL. The maximum permissible value of ABC for 2003 therefore is 1,970 t, which is the Plan Team's recommended value. It is not possible to determine whether the squid complex is overfished or whether it is approaching an overfished condition because it is managed under Tier 6.

The SSC has determined that reliable estimates of the natural mortality rate and biomass exist for all major components of the "other species" complex, thereby qualifying this complex for management under Tier 5. The Plan Team agrees that Tier 5 is the appropriate classification for sculpins and skates. The Plan Team recommends that the natural mortality rates for sculpins and skates be estimated at values of 0.15 and 0.10, respectively, and that biomass be estimated by summing the average biomass estimates from the last 10 years for the EBS shelf trawl survey, the EBS slope trawl survey (where only 1 survey has taken place in the last 10 years), and the AI trawl survey.

However, the Plan Team recommends that the SSC consider changing the classification of sharks and octopus from Tier 5 to Tier 6, because the biomass estimates obtained from the trawl surveys for these two groups appear to be questionable. Because catch estimates for these two groups do not exist prior to the 1990s, the Plan Team recommends that the SSC use catches from the period 1992-2001 as the baseline for applying the Tier 6 formulae.

The above calculations result in the values shown below (biomass and catch are in t):

Group	Tier	Biomass (<i>B</i>)	<i>M</i>	<i>B</i> × <i>M</i>	Catch	0.75× <i>B</i> × <i>M</i>	0.75×Catch
sculpins	5	213,000	0.15	32,000		24,000	
skates	5	482,000	0.10	48,200		36,100	
sharks	6				541		406
octopus	6				387		290
Total				80,200	928	60,100	696

Thus, the Plan Team recommends setting 2003 ABC for BSAI “other species” at a value of 60,800 t (=60,100 t + 696 t, rounding off) and 2003 OFL for BSAI “other species” at a value of 81,100 t (=80,200 t + 928 t, rounding off). It is not possible to determine whether the “other species” complex is overfished or whether it is approaching an overfished condition because it is not managed under Tiers 1-3.

Appendix A: Pacific Halibut Discard Mortality Rates

The report by IPHC staff on the results of analyses of 2001 observer data examining halibut discard mortality rates (DMRs) is included as Appendix A. The report was reviewed in a joint session of the Plan Teams during the November meeting. Following the plan adopted in 2000, halibut bycatch mortality in open access fisheries is managed using a long-term average DMR. IPHC made no recommendations for changes in 2003 from the DMRs used in 2002. The Teams endorse the IPHC recommendations for the CDQ fisheries.

The IPHC recommendations are included in the summary table below. The recommended Preseason Assumed DMRs are based on an average of fishery DMRs during 1990-1999, with the exception of the BSAI hook-&-line fishery for Pacific cod which is based on an average of 1996-1999.

Data for CDQ fisheries were collected in 2001; hook-&-line fishing was directed towards Pacific cod and turbot. Pollock, flathead and yellowfin sole, rockfish, and atka mackerel were targeted by trawls. Pot vessels targeted on cod and sablefish. The DMRs calculated for 2001 for those fisheries were carried forward as recommendations for monitoring in 2003 CDQ targets. The analysis recommends monitoring bycatch mortality in other CDQ targets using the open access DMRs.

Recommendations for Preseason Assumed DMRs for monitoring halibut bycatch mortality in 2003. These represent no change from 2002 for open access fisheries. CDQ values represent data from 2001.

BSAI Target	Recommendations for 2003	GOA Target	Recommendations for 2003
<i>Trawl</i>		<i>Trawl</i>	
Atka mackerel	75	Atka mackerel	70
Bottom pollock	76	Bottom pollock	61
Pacific cod	67	Pacific cod	61
Other Flatfish	71	Deep water flatfish	60
Rockfish	69	Shallow water flatfish	69
Flathead sole	67	Rockfish	69
Other species	67	Flathead sole	58
Pelagic pollock	84	Other species	61
Rock sole	76	Pelagic pollock	72
Sablefish	50	Sablefish	66
Turbot	70	Arrowtooth flounder	62
Yellowfin sole	81	Rex sole	61
<i>Pot</i>		<i>Pot</i>	
Pacific cod	8	Pacific cod	14
Other species	8	Other species	14
<i>Longline</i>		<i>Longline</i>	
Pacific cod	12	Pacific cod	14
Rockfish	25	Rockfish	8
Other species	12	Other species	14
Turbot	18		
<i>CDQ Trawl</i>			
Atka mackerel	80		
Bottom pollock	90		
Pelagic pollock	89		
Flathead sole	90		
Rockfish	90		
Yellowfin sole	83		
<i>CDQ Longline</i>			
Pacific cod	11		
Turbot	4		
<i>CDQ Pot</i>			
Pacific cod	2		
Sablefish	46		

Table 1-- Species categories established for management of the Bering Sea/Aleutian Islands groundfish fishery.

Prohibited Species ^a	Target Species ^b	Other Species ^c	Fish	Forage
<u>FINFISHES</u>				
Salmon	Walleye pollock		Sculpins	Eulachon
Pacific halibut	Pacific cod		Sharks	Capelin
Pacific herring	Yellowfin sole		Skates	Sandlance
Steelhead trout	Greenland turbot			Myctophids
	Arrowtooth flounder			Bathylagids
	Rock sole			Sandfish
	Flathead sole			Pholids
	Other flatfish			Stichaeids
	Sablefish			Gonostomatids
	Pacific ocean perch			
	Other red rockfish			
	Other rockfish			
	Atka mackerel			
<u>INVERTEBRATES</u>				
King crab	Squid		Octopus	
Tanner crab				

a. Species which must be returned to the sea when caught.

b. Species for which an individual TAC is established.

c. Species for which an aggregate TAC is established.

A nonspecified species category is also established to cover all species not listed above.

Table 2. Groundfish and squid catches (metric tons) in the eastern Bering Sea, 1954-2002.

Year	Pollock	Pacific Cod	Sable Fish	Pacific Ocean Perch Complex	Other Rock Fish	Yellow Fin Sole	Greenland Turbot
1954						12,562	
1955						14,690	
1956						24,697	
1957						24,145	
1958	6,924	171	6			44,153	
1959	32,793	2,864	289			185,321	
1960			1,861	6,100		456,103	36,843
1961			15,627	47,000		553,742	57,348
1962			25,989	19,900		420,703	58,226
1963			13,706	24,500		85,810	31,565
1964	174,792	13,408	3,545	25,900		111,177	33,729
1965	230,551	14,719	4,838	16,800		53,810	9,747
1966	261,678	18,200	9,505	20,200		102,353	13,042
1967	550,362	32,064	11,698	19,600		162,228	23,869
1968	702,181	57,902	4,374	31,500		84,189	35,232
1969	862,789	50,351	16,009	14,500		167,134	36,029
1970	1,256,565	70,094	11,737	9,900		133,079	19,691
1971	1,743,763	43,054	15,106	9,800		160,399	40,464
1972	1,874,534	42,905	12,758	5,700		47,856	64,510
1973	1,758,919	53,386	5,957	3,700		78,240	55,280
1974	1,588,390	62,462	4,258	14,000		42,235	69,654
1975	1,356,736	51,551	2,766	8,600		64,690	64,819
1976	1,177,822	50,481	2,923	14,900		56,221	60,523
1977	978,370	33,335	2,718	2,654	311	58,373	27,708
1978	979,431	42,543	1,192	2,221	2,614	138,433	37,423
1979	913,881	33,761	1,376	1,723	2,108	99,017	34,998
1980	958,279	45,861	2,206	1,097	459	87,391	48,856
1981	973,505	51,996	2,604	1,222	356	97,301	52,921
1982	955,964	55,040	3,184	224	276	95,712	45,805
1983	982,363	83,212	2,695	221	220	108,385	43,443
1984	1,098,783	110,944	2,329	1,569	176	159,526	21,317
1985	1,179,759	132,736	2,348	784	92	227,107	14,698
1986	1,188,449	130,555	3,518	560	102	208,597	7,710
1987	1,237,597	144,539	4,178	930	474	181,429	6,533
1988	1,228,000	192,726	3,193	1,047	341	223,156	6,064
1989	1,230,000	164,800	1,252	2,017	192	153,165	4,061
1990	1,353,000	162,927	2,329	5,639	384	80,584	7,267
1991	1,268,360	165,444	1,128	4,744	396	94,755	3,704
1992	1,384,376	163,240	558	3,309	675	146,942	1,875
1993	1,301,574	133,156	669	3,763	190	105,809	6,330
1994	1,362,694	174,151	699	1,907	261	144,544	7,211
1995	1,264,578	228,496	929	1,210	629	124,746	5,855
1996	1,189,296	209,201	629	2,635	364	129,509	4,699
1997	1,115,268	209,475	547	1,060	161	166,681	6,589
1998	1,101,428	160,681	586	1,134	203	101,310	8,303
1999	889,589	134,647	646	609	135	67,307	5,205
2000	1,132,736	151,372	742	704	239	84,057	5,888
2001	1,387,452	142,452	863	1,148	296	63,563	4,252
2002/d	1,469,955	147,509	989	846	397	73,248	2,279

Table 2. (continued)							
Year	Arrow Tooth Flounder	Other Flat Fish	Rock Sole/b	Atka Mackerel	Squid	Other Species	Total (All Species)
1954							12,562
1955							14,690
1956							24,697
1957							24,145
1958						147	51,401
1959						380	221,647
1960	a						500,907
1961	a						673,717
1962	a						524,818
1963	a	35,643					191,224
1964	a	30,604				736	393,891
1965	a	11,686				2,218	344,369
1966	a	24,864				2,239	452,081
1967	a	32,109				4,378	836,308
1968	a	29,647				22,058	967,083
1969	a	34,749				10,459	1,192,020
1970	12,598	64,690				15,295	1,593,649
1971	18,792	92,452				13,496	2,137,326
1972	13,123	76,813				10,893	2,149,092
1973	9,217	43,919				55,826	2,064,444
1974	21,473	37,357				60,263	1,900,092
1975	20,832	20,393				54,845	1,645,232
1976	17,806	21,746				26,143	1,428,565
1977	9,454	14,393			4,926	35,902	1,168,144
1978	8,358	21,040		831	6,886	61,537	1,302,509
1979	7,921	19,724		1,985	4,286	38,767	1,159,547
1980	13,761	20,406		4,955	4,040	34,633	1,221,944
1981	13,473	23,428		3,027	4,182	35,651	1,259,666
1982	9,103	23,809		328	3,838	18,200	1,211,483
1983	10,216	30,454		141	3,470	15,465	1,280,285
1984	7,980	44,286		57	2,824	8,508	1,458,299
1985	7,288	71,179		4	1,611	11,503	1,649,109
1986	6,761	76,328		12	848	10,471	1,633,911
1987	4,380	50,372		12	108	8,569	1,639,121
1988	5,477	137,418		428	414	12,206	1,810,470
1989	3,024	63,452		3,126	300	4,993	1,630,382
1990	2,773	22,568		480	460	5,698	1,644,109
1991	12,748	30,401	46,681	2,265	544	16,285	1,647,455
1992	11,080	34,757	51,720	2,610	819	29,993	1,831,954
1993	7,950	28,812	63,942	201	597	21,413	1,674,406
1994	13,043	29,720	60,276	190	502	23,430	1,818,628
1995	8,282	34,861	54,672	340	364	20,928	1,745,890
1996	13,280	35,390	46,775	780	1,080	19,717	1,653,355
1997	8,580	42,374	67,249	171	1,438	20,997	1,640,590
1998	14,985	39,940	33,221	901	891	23,156	1,486,739
1999	9,827	33,042	39,934	2,008	393	17,045	1,200,387
2000	12,071	36,813	49,186	239	375	23,098	1,497,520
2001	12,836	27,693	28,949	264	1,761	23,148	1,694,677
2002/d	9,941	29,652	40,421	453	1,293	23,267	1,800,250

a/ Arrowtooth flounder included in Greenland turbot catch statistics.

b/ Includes POP shortraker, rougheye, northern and sharpchin.

c/ Rocksole prior to 1991 is included in other flatfish catch statistics.

d/ Data through October 19, 2002.

Note: Numbers don't include fish taken for research.

Table 3. Groundfish and squid catches (metric tons) in the Aleutian Islands region, 1962-2002.

Year	Pollock	Pacific Cod	Sable Fish	Pacific Ocean Perch Complex	Other Rock Fish	Greenland Turbot	Yellow Fin Sole
1962				200			
1963			664	20,800		7	
1964		241	1,541	90,300		504	
1965		451	1,249	109,100		300	
1966		154	1,341	85,900		63	
1967		293	1,652	55,900		394	
1968		289	1,673	44,900		213	
1969		220	1,673	38,800		228	
1970		283	1,248	66,900		285	
1971		2,078	2,936	21,800		1,750	
1972		435	3,531	33,200		12,874	
1973		977	2,902	11,800		8,666	
1974		1,379	2,477	22,400		8,788	
1975		2,838	1,747	16,600		2,970	
1976		4,190	1,659	14,000		2,067	
1977	7,625	3,262	1,897	8,080	3,043	2,453	
1978	6,282	3,295	821	5,286	921	4,766	
1979	9,504	5,593	782	5,487	4,517	6,411	
1980	58,156	5,788	274	4,700	420	3,697	
1981	55,516	10,462	533	3,622	328	4,400	
1982	57,978	1,526	955	1,014	2,114	6,317	
1983	59,026	9,955	673	280	1,045	4,115	
1984	81,834	22,216	999	631	56	1,803	
1985	58,730	12,690	1,448	308	99	33	
1986	46,641	10,332	3,028	286	169	2,154	
1987	28,720	13,207	3,834	1,004	147	3,066	
1988	43,000	5,165	3,415	1,979	278	1,044	
1989	156,000	4,118	3,248	2,706	481	4,761	
1990	73,000	8,081	2,116	14,650	864	2,353	
1991	78,104	6,714	2,071	2,545	549	3,174	1,380
1992	54,036	42,889	1,546	10,277	3,689	895	4
1993	57,184	34,234	2,078	13,375	495	2,138	0
1994	58,708	22,421	1,771	16,959	301	3,168	0
1995	64,925	16,534	1,119	14,734	220	2,338	6
1996	28,933	31,389	720	20,443	278	1,677	654
1997	26,872	25,166	779	15,687	307	1,077	234
1998	23,821	34,964	595	13,729	385	821	5
1999	965	27,714	565	17,619	630	422	13
2000	1,244	39,684	1,048	14,893	601	1,086	13
2001	824	34,207	1,074	15,587	610	1,060	15
2002/c	1,079	30,741	1,038	14,859	524	436	27

Table 3. (continued)

Year	Rock Sole	Other Flat Fish	Arrow Tooth Flounder	Atka Mackerel	Squid	Other Species	Total (All Species)
1962							200
1963			a				21,471
1964			a			66	92,652
1965			a			768	111,868
1966			a			131	87,589
1967			a			8,542	66,781
1968			a			8,948	56,023
1969			a			3,088	44,009
1970			274	949		10,671	80,610
1971			581			2,973	32,118
1972			1,323	5,907		22,447	79,717
1973			3,705	1,712		4,244	34,006
1974			3,195	1,377		9,724	49,340
1975			784	13,326		8,288	46,553
1976			1,370	13,126		7,053	43,465
1977			2,035	20,975	1,808	16,170	67,348
1978			1,782	23,418	2,085	12,436	61,092
1979			6,436	21,279	2,252	12,934	75,195
1980			4,603	15,533	2,332	13,028	108,531
1981			3,640	16,661	1,763	7,274	104,199
1982			2,415	19,546	1,201	5,167	98,233
1983			3,753	11,585	510	3,675	94,617
1984			1,472	35,998	343	1,670	147,022
1985			87	37,856	9	2,050	113,310
1986			142	31,978	20	1,509	96,259
1987			159	30,049	23	1,155	81,364
1988			406	21,656	3	437	77,383
1989			198	14,868	6	108	186,494
1990			1,459	21,725	11	627	124,886
1991	n/a	88	938	22,258	30	91	117,942
1992	236	68	900	46,831	61	3,081	164,513
1993	318	59	1,348	65,805	85	2,540	179,659
1994	308	55	1,334	69,401	86	1,102	175,614
1995	356	47	1,001	81,214	95	1,273	183,862
1996	371	61	1,330	103,087	87	1,720	190,750
1997	271	39	1,071	65,668	323	1,555	139,049
1998	446	54	694	56,195	25	2,448	134,182
1999	577	53	746	51,636	9	1,633	102,582
2000	480	113	1,157	46,990	8	3,010	110,327
2001	526	97	1,220	61,296	5	4,029	120,550
2002/c	1,082	138	991	44,433	9	1,894	97,251

a/ Arrowtooth flounder included in Greenland turbot catch statistics.

b/ Includes POP shortraker, rougheye, northern and sharpchin rockfish.

c/ Data through October 19, 2002.

Note: Numbers don't include fish taken for research.

Table 4-- Summary of stock abundance (biomass), overfishing level (OFL), acceptable biological catch (ABC), the fishing mortality rate corresponding to ABC (F_{OFL}), and the fishing mortality rate corresponding to OFL (F_{ABC}) for the eastern Bering Sea (EBS), Aleutian Islands (AI), and Bogoslof district as projected for 2003. "Biomass" corresponds to projected January 2003 abundance for the age+ range reported in the summary section. Biomass, OFL, and ABC are in metric tons, reported to three significant digits. Fs are reported to two significant digits.

Species or Species Complex	Area	Biomass	OFL	ABC	F_{OFL}	F_{ABC}
Walleye pollock	EBS	11,100,000	3,530,000	2,330,000	1.10	0.52
Walleye pollock	AI	175,000	52,600	39,400	0.20	0.30
Walleye pollock	Bogoslof	227,000	45,300	34,000		0.019
Pacific cod	BSAI	1,680,000	294,000	223,000	0.41	0.28
Yellowfin sole	BSAI	1,554,000	136,000	114,000	0.14	0.12
Greenland turbot	BSAI	112,000	17,800	5,880	0.32	0.10
Arrowtooth flounder	BSAI	597,000	139,000	112,000	0.30	0.22
Rock sole	BSAI	877,000	132,000	110,000	0.21	0.18
Flathead sole	BSAI	550,000	81,000	66,000	0.37	0.29
Alaska plaice	BSAI	1,083,000	165,000	137,000	0.21	0.28
Other flatfish	BSAI	107,000	20,000	15,000	0.20	0.15
Sablefish	EBS	31,000	4,290	2,550	0.16	0.13
Sablefish	AI	39,000	4,590	2,740	0.16	0.13
Pacific ocean perch	BSAI	375,000	17,900	15,100	0.056	0.047 ^a
Northern rockfish	BSAI	156,000	9,330	7,000	0.0	0.045 ^a
Shortraker/Rougheye rockfish	BSAI	32,000	1,290	967	0.025	0.019- 0.22 ^b
Other rockfish	EBS	18,000	1,280	960	0.073 ^b	0.053 ^b
Other rockfish	AI	15,000	846	634	0.073 ^b	0.053 ^b
Atka mackerel	AI	358,300	99,700	51,000	0.84	.44
Squid	BSAI	n/a	2,625	1,970	n/a	n/a
Other species	BSAI	695,000	25,760	19,320	0.15	0.11
TOTAL		19,781,300	4,780,711	3,288,521		

a/ previously combined into other red rockfish complex

b/ Weighted average of species-specific rates.

Table 5-- Summary of BSAI groundfish tier designations under Amendment 56, maximum permissible ABC fishing mortality rate ($\max F_{ABC}$), the Plan Team's recommended ABC fishing mortality rate (F_{ABC}), the maximum permissible value of ABC ($\max ABC$), the Plan Team's recommended ABC, and the percentage reduction (% Red.) between $\max ABC$ and the Plan Team's recommended ABC. Insofar as the SSC has final authority for tier designations, the designations shown here represent Plan Team recommendations only. Biomass and ABC are in metric tons, reported to three significant digits. Fishing mortality rates are reported to two significant digits. In cases where $\max ABC$ and the Plan Team's recommended ABC are equal, the percentage reduction is left blank. All values pertain to the 2002 harvest season.

Species or Species Complex	Area	Tier	$\max F_{ABC}$	F_{ABC}	$\max ABC$	ABC	% Red.
Walleye pollock	EBS	1a	0.52	0.52	2,330,000	2,330,000	
Walleye pollock	AI	5	0.30	0.30	39,400	39,400	
Walleye pollock	Bogoslof	5	0.019	0.019	34,000	34,000	
Pacific cod	BSAI	3b	0.35	0.28	278,000	223,000	20
Yellowfin sole	BSAI	3a	0.12	0.12	114,000	114,000	
Greenland turbot	BSAI	3a	0.26	0.10	14,700	5,880	60
Arrowtooth flounder	BSAI	3a	0.22	0.22	112,000	112,000	
Rock sole	BSAI	3a	0.18	0.18	110,000	110,000	
Flathead sole	BSAI	3a	0.29	0.29	66,000	66,000	
Alaska plaice	BSAI	3a	0.28	0.28	137,000	137,000	
Other flatfish	BSAI	5	0.15	0.15	15,000	15,000	
Sablefish	BS	3b	0.13	0.13	3,520	2,550	28
Sablefish	AI	3b	0.13	0.13	3,780	2,740	28
Pacific ocean perch	BSAI	3b	0.047	0.047	15,100	15,100	
Northern rockfish	BSAI	5	0.045	0.045	7,000	7,000	
Shortraker, Rougheye rockfish	BSAI	5	0.022, 0.019	0.022, 0.019	967	967	
Other rockfish	EBS	5	0.053	0.053	960	960	
Other rockfish	AI	5	0.053	0.053	634	634	
Atka mackerel	BSAI	3a	0.66	0.44	82,800	51,000	33
Squid	BSAI	6	n/a	n/a	1,970	1,970	
Other species	BSAI	5,6	0.11	0.11	19,320	19,320	
Total						3,288,521	

Figure 1. BSAI Statistical and Reporting Areas

BSAI Statistical and Reporting Areas

